AMENDMENTS TO THE SPECIFICATION

Please replace the following paragraphs as indicated below.

The paragraph beginning on page 1, line 4:

The present invention concerns methods for reducing detrimental phenomena related to disturb voltages in a data storage apparatus employing passive matrix addressing according to the introduction of claim 1, wherein the data storage cells of the data storage apparatus are provided in two or more electrically separated segments, each segment comprising a separate physical address space of the data storage apparatus.

The paragraph beginning on page 7, line 3:

It is often desirable, or even required, to internally divide the passive matrix structure into smaller "sub-matrices" or "segments", for instance to reduce power requirements or to reduce the number of disturbed cells during addressing. Segmentation may be accomplished in various ways, and for ~~example~~ instance be partial as disclosed in the present applicant's international published application W02/25665, which ~~also discloses further prior art on segmentation of passive matrices~~ in a preferred embodiment teaches the use of electrically segmented word lines in passive matrix-addressable ferroelectric memories.

The paragraph beginning on page 7, line 18:

- An addressing operation on a cell in ~~one~~ a segment ~~only shall give arise to~~ shall only cause substantial disturb voltages in the same segment.

The paragraphs beginning on page 8, line 15:

The above objects as well as further advantages and features are realized with a method according to the invention ~~as disclosed in the characterizing portion of independent claim 1~~ comprising setting in a first addressing operation constituting a first part of an addressing cycle one or more addressed data storage cells in one of the segments to a first polarization state by means of a first active voltage pulse in the first addressing operation, during which each bit line dependent on the voltage pulse protocol can be connected with a sensing means for detecting the polarization state of the data storage cell at least under a part of the duration of the first active voltage pulse; applying to the one or more addressed data storage cells in the one segment dependent on the voltage pulse protocol a second voltage pulse which can be a second active voltage pulse of opposite polarity to that of the first active voltage pulse and switching the addressed data storage cell from the first polarization state to a second polarization state, such that each cell being addressed is set to a predetermined polarization state as specified by the first addressing operation; applying in a second addressing operation the second voltage pulse to one or more data storage cells in another segment, such that one or more data storage cells in the other segment are preset to either the first polarization state or the second polarization state; and dependent on the addressing operation to be carried out, storing information in said one or more preset data storage cells in the other segment after the second active voltage pulse with the same polarity has been applied thereto, said another segment being selected for the second addressing operation on the basis of prior application of active voltage pulses to said two or more electrically separated segments.

Further features and advantages shall be apparent from the appended dependent claims.

The paragraph beginning on page 10, line 19:

fig. 17 flow chart of an embodiment similar to that in figure ~~15~~ 16, but where the conditional delay is replaced by a mechanism using segment table time stamps,

The paragraph beginning on page 11, line 25:

fig. 28 a first embodiment of a device that may be used for implementing the method of the invention using the main memory to directly handle data, and

The paragraph beginning on page 15, line 16:

By studying the intervals exemplified in figure ~~7~~ 9, it is revealed that consecutive operations addressing the same segment are one factor that negatively affects the data rate and hence should be avoided.

The paragraph beginning on page 21, line 7:

Figure 15 shows an embodiment of the method according to the present invention that concerns un-setting of 'lock-state' marks based on elapsed time since segment accesses. In step 1501 of fig. 15, the first segment entry of the segment table is read and then it is checked if the 'lock state' mark is set in ~~figure~~ step 1502. If that is not the case, the next segment entry is read in step 1505 and the check is repeated; if the 'lock state' mark is set, a step 1503 follows wherein the present time and the timestamp is compared and in case the difference exceeds a predetermined value, the 'lock state mark' of the segment entry is unset in step 1504; then the next segment entry is read in step 1505. If the difference between present time and the 'timestamp of last segment access' as found in step 1503 is not exceeding the predetermined value, the 'lock state' mark should not be unset; instead the next segment entry is directly read in step 1505. After all the segment entries have been cycled through, the procedure is repeated and the first segment entry is read again in step 1501 etc. The two consecutive checks in steps 1502, 1503 may seem time-consuming, but since a 'lock state' mark typically is of the size of a bit and follows the timestamp in the segment table, as for example as illustrated in figure 14, the two checks in steps 1502, 1503 may easily be performed at the same time in a device implementing the method. Thus, the un-set procedure can be carried out without significant speed penalty in conjunction with e.g. read and write operations that are part of the regular operation of the device. Additionally, the un-set procedure can be performed during idle time periods, optionally coordinated with relocation of pre-set cells among segments or with creation of new pre-set cells in selected segments.

The paragraph beginning on page 32, line 13:

IV) or V) READ ONCE or ERASE / PRE-SET. For these operation variants only the first ~~six~~ five steps 2001-2005 need to be executed. In the update of appropriate segment information in

the last of these steps 2005, nothing should be updated. The reason for not adding the address to the segment table is explained as follows: Cells pre-set by these operation variants are listed in the address mapping table, the other pre-set cells are not. Listing cells pre-set by these operation variants in the segment table as well, would result in that some, but not all, of the pre-set cell addresses in the segment table would be listed in the address mapping table, which is a situation that is not handled by the other operation variants according to this embodiment. It would also result in an unwanted permanent increase of the total number of pre-set cell addresses listed in the segment table since no other operation variant in this embodiment results in a decrease.

The paragraph beginning on page 33, line 26:

Figure 21 illustrates yet another embodiment of a method according to the present invention, ~~which~~ and includes pre-set cell handling similar to figure 20, ~~but where the last step 2011 in figure 20 that handles pre-set cells during by exchanging physical addresses in the address mapping table instead of resorting to replacing the physical addresses as is the case of step 2011~~ which differs in regard of the last step 2111 which concerns interchanging the locations of address entries. In step 2011 the first physical address is replaced by the second, while in step 2111 in fig. 21 the first physical address entry shall change location with the second physical address entry in the address-mapping table. Figure 21 in particular shows a I) READ WITH WRITE-BACK, II) WRITE and a III) READ WITH WRITE-DIFFERENT operation. Only step 2111 which has no counterpart in figure 20 shall now be described. In step 2111 in figure 21, the locations of the second and the first physical address are exchanged in the address mapping table instead of replaced as in previous embodiments. This implies that the logical address given by the operation, which was first referring to the first physical address, now instead is referring to the second physical address and that another logical address, which first was referring to the second physical address of pre-set cells, now instead is referring to the first physical address of pre-set cells. Even though the exchange involves changing physical address of a logical address that is not involved in the operation, something which normally is not recommended, the content of the address, i.e. pre-set cells, is still the same and consequently there should be no negative side effect. In the last step 2111, in connection with the physical address exchange, appropriate

address entry information in the address mapping table should be updated, which involves setting the 'pre-set' mark and the 'pre set polarization A' mark at the first physical address to indicate that the first physical address now is containing pre-set cells of polarization state A, and unsetting the 'pre-set mark' at the second physical address to indicate that the second physical address no longer contains pre-set cells.

In the paragraphs of page 34, line 18 to page 35 line 16:

IV) or V) READ ONCE or ERASE / PRE-SET. For these operation variants only the first ~~six~~ five steps 2101-2105 need to be executed. If the address subjected to any of these operation variants should not be stored in the system as a pre-set cell address, nothing needs to be updated in the update of appropriate segment information in the last of these steps 2105. However, if the address should be recognized and it is possible to use as any other pre-set cell address afterwards, the update of appropriate segment information in the last step 2105 should be handled in the same way as described above for ordinary operations, i.e. adding the first physical address as a physical address entry with the 'pre-set polarization A' mark set to indicate that the cells have been pre-set to polarization state A and increasing the 'number of pre-set cell addresses' by one. In addition to this it is also required to add two extra steps: 1) update of address entry information in the address mapping table by setting the 'pre-set' mark and the 'pre-set polarization A' mark, and 2) increase any variable keeping track of the total number of pre-set cell addresses by one. Use of the variable will be explained in connection with the operation variant discussed below.

VI) WRITE TO PRE-SET. This operation variant may be executed on any logical address that is known to store pre-set cells. In figure ~~20~~ 21, the first step 2101 should be executed, then the next four steps 2102-2105 may be bypassed. The following steps 2106-2111 are the same as described for the ordinary operations. This operation variant will result in that the pre-set cells used for write are not the same as first linked to the logical address given by the operation; further the result will be a decrease of the total number of pre-set cell addresses since no new pre-set cells are created. Consecutive application of this operation variant therefore entails a risk that all pre-set cells in the system are consumed. Since application of the present invention is

based on the availability of an adequate number of cells that have been pre-set, this operation variant should not be applied if the total number of pre-set cell addresses is below a certain limit. To be able to keep track of this, a variable storing the total number of pre-set cell addresses can be used. As long as that variable exceeds a predetermined value, application of this, operation variant IV is permitted.

In the paragraph beginning on page 43, line 3:

IV) or V) READ ONCE or ERASE / PRE-SET. These operation variants should only be executed on non pre-set cell addresses. Only the first steps ~~2607-2610~~ 2601-2606 involving the first physical address need to be executed. If the address subjected to any of these operation variants should not be stored in the system as a pre-set cell address, nothing needs to be updated in the update of appropriate segment information in the last of these steps 2606. However, if the address should be recognized and possible to use as any other pre-set cell address afterwards, the update of appropriate segment information in the last step 2606 should be handled in the same way as described above for ordinary operations, i.e. adding the first physical address as a physical address entry with the 'pre-set polarization A' mark set to indicate that the cells have been pre-set to polarization state A and increasing the 'number of pre-set cell addresses' by one. In addition to this it is also required to add two extra steps, viz. 1) update of address entry information in the address mapping table by setting the 'pre-set' mark and the 'pre-set polarization A' mark, and 2) increase any variable keeping track of the total number of pre-set cell addresses by one.

In the paragraph beginning on page 43, line 23:

Figure 27 shows yet another embodiment of a method according to the present invention, which takes advantage of a dynamic number of system visible pre-set cells together with a fixed number of system invisible pre-set cells. To achieve higher operational data rate for write operations the embodiment in figure 27 utilizes the fact that system visible pre-set cells may be consumed and decrease in amount. Figure 27 in particular shows I) READ WITH WRITE-BACK, II) WRITE and III) READ WITH WRITE-DIFFERENT operations. Basically figure 27 is a superset of the embodiment presented in figure 26 except ~~from~~ for steps ~~2603,~~ 2602 and

2604, the counterparts of which are excluded in figure 27 for purpose of convenient presentation. Hence there shall now only be focused on distinguishing steps: If the check of the 'pre-set' mark in the second step 2702 results in an unset mark, i.e. non pre-set cells are found at the first physical address, a second physical address is retrieved in step 2703 from first position in the segment table queue 2703. In the next step 2704 it is checked if the current operation is a write operation and if the second physical address is listed in the address mapping table, i.e. system visible. If this is not true, the continuation is identical to corresponding steps in figure 25, but in case the operation is a write operation and if the pre-set cells at the second physical address are system visible, some steps 2705, 2706, 2707 may be bypassed and application of the second voltage pulse in step 2708 may directly follow. Note that if a second physical address needs to be retrieved twice in step 2703, 2707, it is the latest retrieved second physical address that will be used in the consecutive steps 2708, 2709, 2710, 2711, 2712. The last steps 2709, 2710, 2711, 2712 in figure 27 are identical to those presented in steps 2509, 2510, 2511, 2512 in fig. 25, except from the last step 2712, wherein it cannot be assumed that the fist physical address contains pre-set cells in the update of appropriate address entry information. Instead the update should be handled in correspondence with the description of the corresponding step 2610 in figure 26.

In the paragraph beginning on page 49, line 24:

-Memory cell accesses will be distributed among the segments, which in turn will ~~reduce~~ increase the time until a cell reaches the critical number of switches due to fatigue.